



FCC NOTICE #27

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Interoperable Video Device Comments, Analysis & Solution

**White Paper by
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1 ABSTRACT

This White Paper is the result of FCC's Notice #27 (Dec. 3rd 2009) seeking Comments on Video Device Innovation. The paper summarizes the comment of various stake-holders. It lists the various issues which have emerged with the "for" and "against" positions of the stake-holders. It then analyzes the comments for the possible path-forward for achieving the FCC's long term goals. The key realization is that the goals will have to be achieved, not through new mandates but rather by relaxing some of the earlier ones, as desired by the industry. A "Holistic Solution" is then proposed which makes use of existing infrastructure and devices, and yet allows emergence of an "interoperable Video Device", which can be retailed. The solution would allow, in the spirit of internet, universal access of both the internet and MVPD's contents.

2 EXECUTIVE SUMMARY

Net Magic has a team of researchers who have garnered rich experience in field trials of pioneering technologies in the world – it was thus a fresh challenge to them to find out a solution to the FCC's problem, based on their own experience in making a converged box which could be retailed. NetMagic posted its Comment on FCC's Notice #27 on December 21st 2009.

Since then, NetMagic has been able to study on FCC's websites the Comments of various stake holders too. It has thus been able to gain a deeper insight into the problems for which the solution doesn't lie in technology alone. The solution has to be a win-win for all the stake-holders – otherwise it would be resisted.

From the Comments, NetMagic has perceived an undercurrent, where most of the industry doesn't want FCC to mandate a "network agnostic" solution, and believes that it will hammer itself out through sheer forces of competition. Some

MVPDs don't believe that "IP STB" is the way to increase the broadband penetration. The industry attitude seems to have hardened, as some of the earlier steps taken by FCC for mandating Cable Card and 1394 industry has not led to the expected results, and had actually harmed the growth of small and medium cable operators.

NetMagic therefore believes that a "holistic solution" has to be accommodative, such that while fulfilling the basic aims of the FCC and consumers, it leads to further growth of the stake holder by expanding the market itself.

At this moment, it would be futile to mandate development of new devices such as Home Gateways, which would get mired with standards development and enforcement problems. An ideal solution would lie in use of the "existing devices" themselves with utmost a software upgrade. It would be a bonanza, if the consumer would be able to use some of the popular internet video devices themselves, on the MVPD networks too.

Considering the enormous amount of infrastructure developed by the cable industry in the past decade, Netmagic believes that it will be futile to ask them to yet again change their basic building blocks or their existing business practices. Considering that the RF QAM Cable based channel delivery has many inherent limitations, it would be best not to tinker with their existing solutions. Let the existing channel delivery solutions continue through the "leased integrated boxes" as desired by the cable MVPDs.

On the other hand, the IP world is rapidly evolving and is the future as admitted even by the Cable MVPDs. It may be better to supplement the existing QAM infrastructure of the cable MVPDs with interoperable IP infrastructure. This would be possible if the retail Video Device, gives up the quest of trying to get the Channels and TV Guides too (which has been the bottle-neck), and instead concentrate on giving a wonderful Navigation experience with the MVPD's VOD contents. As the VOD contents can include all the episodes of the popular TV programs (as already entrenched on the internet), the user's path-of-least resistance would change. Now his TV viewing habits would be unaffected by his time constraints and the tedium of pre-planning the recordings of what he wants to watch later.

The user will ultimately be the biggest beneficiary, when he is able to use the existing STB supplied by the MVPD for his usual live channel browsing, and use the retail Video Devices for all the VOD contents. The user may not even have to buy any new device, as his existing Cable Modem will be sufficient for allowing the Ethernet based Video Devices to access the HTTP Content Servers at the MVPD head-ends. He can even upgrade his existing PC or internet devices, through software downloads.

Accordingly Netmagic is proposing an optimized “Holistic Solution” to the FCC, which is simple in spirit and can accommodate the interest of all the stakeholders: the consumers, the MVPDs, the CE manufacturers, the Content owners, the DRM providers and the FCC. The Solution allows the Video Devices to be used on Internet or MVPD networks, and access commercial “Universal content”. Universal content have unique “Universal Content ID” for allowing them to be neatly organized on HTTP Servers for ease in navigation, and searched through Internet search engines.

The Holistic Solution effectively overcomes the problem of standardizing on a DRM or developing an open DRM, by allowing multiple DRMs to co-exist with the MVPDs (in the manner of European Simulcrypt). It would allow an existing Video Device to support a DRM through just a software upgrade. It will also allow emergence of new Video Devices, which can support multiple “downloadable” DRMs. The Holistic Solution effectively decouples distribution of encrypted contents, from the fetching of the associated “License key” required for viewing. This opens up the world of content sharing, as per the trends on the internet, while ensuring payment for each and every usage in a transparent way.

The Holistic Solution will expand the market for contents, allowing different business models for different geographical locations. It will, once for all, take away the problem of Piracy. It will create a new world where the secure contents can float freely in any media and yet accounted for when viewed. This solution, in the manner of internet, should rapidly spread across the world and accommodate the needs of all MVPDs.

3 COMMENT SUMMARY

FCC Notice #27, Released on December 3rd 2009, was open for Comments till December 21st 2009.

Comment summary from major organization is given in the order of their appearance on the FCC web site for Proceeding No. 97-80

	NAME (Associations/Alliances in Bold)	COMMENTS	Objective
1	RVU Alliance	Advocating use of RVU Server/Client in homes.	Use RVU
2	Nagravision, Kudelski group	FCC should decouple CA suppliers from STB suppliers. Adopt Simulcrypt for multiple MPVD support, instead of CableCard Network specific functionality should be confined to the Home Gateways, and Navigation devices should be free from it.	Use Simulcrypt.
3	DirectTV	An "All MVPD" device for cable, telco and satellite would be very difficult.	No Regulation needed
4	CISCO	A mandate requiring Internet Video in STB is not necessary. Separable security has just added cost of the box, which consumer still wants to only lease.	No Regulation needed
5	Cablevision System Corporation	Third party devices are being promoted through Downloadable CAS. Any Regulation at this stage is not necessary	No Regulation needed
6	Verizon	FCC should promote Network agnostic solutions rather than Cable Centric. Should remove obsolete Cable Card & 1394. Should promote a standards based Gateway, rather than standardize it. Prefers ATIS DLNA and RVU for home networking. Who said, all the broadband browsing will be done on TV – other devices may be preferred.	No Cable Card & 1394. Use Gateway,
7	Google	For Consumer "Content is the King", he is not bothered about the pipe, CPU or the display. Video devices should be developed, free of MVPD constraints.	Network agnostic Video Devices needed.

		FCC should get CableCard and Home Gateway implemented properly.	
8	Motorola	<p>Cable Card and 1394 technology have been an unnecessary burden for the consumer.</p> <p>Cable Card is being superseded by DRM.</p> <p>Govt. should allow market to develop on its own and not give any mandates.</p> <p>IP enabled boxes reduce cost through elimination of unnecessary functionalities.</p>	<p>No CableCard or 1394.</p> <p>No Regulations needed.</p>
9	Alliance for Telecommunication Industry Solutions (ATIS)	<p>ATIS is global standards development and technical planning organization. Members are from ICT industry. It has IPTV Interoperability Forum.</p> <p>Govt should allow ATIS to take standardization initiatives.</p>	ATIS can help in standardizing.
10	Beyond Broadband Technology	<p>Developed a Downloadable Conditional Access System, which can be used even with a USB thumb drive.</p> <p>Requires special Hardware at the Head-end side.</p> <p>Does not require "trusted Authority"</p>	Use our downloadable CA System.
11	TIVO	<p>Wants a Gateway with minimal uPNP and without DLNA.</p> <p>Wants no Certification hassles.</p>	Minimal Gateway
12	National Cable & Telecommunications Association (NCTA)	<p>-Have a Notice of Inquiry</p> <p>Citing complexity of servers, networks, middleware, agreements, patent-pools etc.</p> <p>-Why impose a network agnostic box only on Cable MVPDs, include the DBS and Telco MVPDs too.</p> <p>-Who says that internet penetration would increase with the TV medium?</p> <p>- Security requirements for the Content Agreements won't allow Gateways & DLNA to be accepted for content distribution</p> <p>-Commission can give waivers for CableCard and 1394.</p> <p>-FCC is prohibited from treating Cable MVPD's as only carriers.</p>	<p>No Regulation needed.</p> <p>Cable Card and 1394 not needed</p> <p>Gateway not viable.</p>
13	Auction Networks	Believe that Xbox and PS3 are the powerful convergent platforms for the future for HD contents.	Use Xbox and PS3
14	NetMagic Solutions	<p>Open DRM Solution for achieving the FCC objectives.</p> <p>An All MVPD device is easily possible which is cost-effective for retail viability.</p>	<p>Open DRM required for interoperability.</p> <p>All-MVPD Video Device viable.</p>

15	Irdeto	CableCard problem has come because of Motorola, Cisco Duopoly. DVB Simulcrypt should be used for allowing competition with STB's worldwide.	Use Simulcrypt
16	1394 Trade Association	Don't give waiver for 1394	1394 needed.
17	Consumer Electronic Association (CEA)	Don't give waiver for 1394. As CEA was also a party for its promulgation.	1394 needed.
18	Texas Instruments	Continue with the 1394 standard, and force cable operators to enable the bidirectional features. HANA can be used for networking with 1394, with built in content protection.	Use 1394 with HANA
19	Transparent Video Systems	Use DVB Simulcrypt, for portability of contents Don't use CableCard. Use SD/micro SD based detachable security	Use Simulcrypt,
20	M3X Media	Cable operators are morphing into broadband operators.	Use GRUVme.
21	Digital Living Network Alliance (DLNA)	A Gateway device is like a Cable Modem. It should use DLNA for talking to Digital Media Players. It can translate video formats for the home network.	Use DLNA in the Gateway device.
22	Sony Electronics	Key to broadband adoption is integration of Internet delivered video contents with MVPD delivered contents. MVPDs are though threatened by Internet videos, Incompatibility is due to CA and lack of access information. Cost of integration has to be low enough to make a retail device compete with a leased device.	Video Device for Internet and MVPD videos.
23	Dish Network	Commission had ruled earlier that interoperability is not required between Cable and Satellite. Telco/Cable/Satellite have different architectural requirements and should develop independently. Even in Europe which uses DVB standard, a common device for all the satellites is not available.	No interoperability needed. No Regulation needed.
24	Intel Corporation	Supports a Convergent video device, with DLNA, DTCP-IP and uPnP. MVPDs should provide a Home Gateway with DLNA. Want 1394 to be made not mandatory.	Gateway with DLNA. No 1394
25	Consumer Electronics Retailers Coalition (CERC)	Original proponent in 1996 of the Section 629 for Competitive Consumer devices. The Implementation has been a failure because of inadequacy of standards made by Cable Lab. Lack of proper Support for Plug& Play and prevalence of Subsidy and Bundling.	Section 629 objectives have been defeated. Cable CARD should be

		A DVR market has not emerged, like that of VCR. Rulemaking should be done for mandating a Gateway.	enforced. Rulemaking for Gateway required. Remove Integration Ban
26	Baja Broadband Operating Company	Commissions Integration Ban has affected Baja's viability, and allowed its competitor unaffected by the ban to take away market share. Congress has mandated that FCC should give waivers, where justified in public interest. Waiver is needed to be able to buy refurbished STB and DVR at less than half cost.	
27	American Cable Association (ACA).	Small and Medium Cable Operators have suffered due to Integration Ban. They have further not been able to upgrade their networks to all digital. CISCO/Motorola Duopoly has prevented them from using lower cost third party STBs. This wouldn't have happened with Simulcrypt CA.	Remove Integration ban Use Simulcrypt. .
28	Time Warner Cable	Unregulated internet device market is thriving, so can happen in Cable. Consumers prefer leased STB over retail. Common gateway standards will be impossible to derive. Should apply to all MVPDs not just cable.	No regulations needed.
29	Public Knowledge, Free Press, Media Access Project, Consumers Union, CCTV Centre for Media & Democracy, Open Technology Initiative	A Common Gateway between All-MVPDs is needed for interoperable retail devices. The Notice is equivalent to a NOI. The Commission should proceed directly to Notice of Proposed Rulemaking for requiring Gateway. Freeze all separable security waiver requests until the rules are updated,	Freeze Waiver. Rulemaking for mandating Gateways.

3.1 ISSUES

Everyone agrees on growing importance of internet videos on TVs. They agree that in the long term everything will be on IP basis. Internet delivery of videos to TVs will become increasingly important.

There are though differences on other fundamental issues, both about the FCC mandate and about the technologies involved.

3.1.1 Mandate Issues

3.1.1.1 Regulations Needed

For

- FCC implementation has been a failure because of lack of proper standards by CableLabs, inadequacy of support, and prevalence of Subsidy and Bundling. Regulation should be stricter. [CERC]

Against

- We are already doing what is necessary. No regulation is necessary. [DirectTV, CISCO, Motorola, Cablevision, NCTA, DISH, Time Warner,]
- FCC shouldn't mandate anything, as that will only delay the natural evolution of what it also wants. Govt. mandated devices cannot catch up with advances in technology. (DirectTV, Motorola)
 - o **Lowest Common denominator device**, would risk early obsolescence.
- FCC is prohibited from treating Cable MVPDs as only Carriers. [NCTA]

3.1.1.2 Notice of Inquiry (NOI) vs. Proposed Rulemaking [NPRM]

NOI

- Imposing Regulation will have more costs than benefits. Have NOI [NCTA, Cable Vision]
- FCC should understand marketplace with NOI. [Time Warner, CISCO, Motorola]

NPRM

- Skip NOI, go directly to Rulemaking [CERC]
- Commission should treat the Notice as NOI and proceed directly to Rulemaking for required Gateway. [Public Knowledge]
- FCC should have a comprehensive review and oversight of the video landscape and issue NPRM to implement targeted reforms [Google]

3.1.1.3 Network Agnostic Video Device

For

- Navigation devices should be free from network specific functionality. [Nagra, Google, Netmagic, Intel]
- FCC should promote Network Agnostic solution, rather than cable centric. [Verizon]

Against

- "Why develop network agnostic box for Cable alone, have it for Telco and Satellite too". Separation of Navigation and Management functions are not acceptable to the Cable Operators. [NCTA]
- Congress itself directed the Commission not to compromise security when adopting rules for navigation devices. Any network interface approach would have to account for the business necessity of such content protection. [NCTA]

3.1.1.4 Internet penetration will increase through TVs

For

- Broadband adoption will increase with video contents being delivered both through Internet and MVPDs onto TVs. [Sony]
- "But allow us to convert our Analog Channels to Digital Channels, by first being able to afford the new boxes. All our broadband plans have got delayed." [Baja, ACA]

- Video device reform is an important component of the National Broadband Plan. [Public Knowledge]

Against

- Mandating Internet Video capability in STBs is unnecessary [CISCO]
- It is wrong to believe that internet penetration will be increased through the STB along with TVs. [NCTA]
- Consumers have many options for internet access which may be preferred over TV: PCs, Net-books, portable WiFi devices and Smart-phones. [Verizon]

3.1.1.5 Integration Ban

For

- Freeze all security waiver requests till new Rulemaking occurs.[Public Knowledge]

Against

- Commission's Integration Ban has affected viability of small and medium Cable Operators. Waiver is needed. [Transparent Video System, Baja, ACA]

3.1.1.6 Mandating a Gateway Device

For

- FCC should get a Gateway implemented properly. [Google, Public Knowledge]
- Use a minimal Gateway with uPnP, but not DLNA. [TIVO]
- Use DLNA in Gateway. Gateways should be like broadband modems to video devices. [DLNA, Intel]

- Commission should require all MVPDs to make available a Home Gateway to subscribers. [CERC]

Against

- Government should not mandate a Gateway device. Developing such would be very expensive and time consuming. [DirectTV, Time Warner]
- Promote a standards based Gateway (as being developed by ATIS), rather than a new standard for it. [Verizon]
- Security requirements from the Content Aggregators won't allow Gateway to be accepted. [NCTA]
- Complex issues: How can parts of service – such as VOD and EPG be altered without running afoul of the hundreds of patents (eg. Sea Change and Gemstar) around which current implementations have been developed. [NCTA]

3.1.1.7 An All-MVPD device for Cable, Satellite and IP

For

- An All MVPD device is easily possible and would be cost-effective for retail viability. [Netmagic]
- A Common Gateway between All-MVPD is needed for interoperable retail devices [Public Knowledge]
- Intel visualizes consumer access to contents, anywhere, anytime, using digital devices that seamlessly store and share media from all sources. It should not matter to consumer as to where the contents came from. [Intel]

Against

- Satellite TV (one-way) should not be linked with IPTV (two-way), and boxes should not have to cater to both [DirectTV]
- An “All MVPD” device for Cable, telco and satellite will be very difficult. It involves negotiations with DirecTV, DISH Network, CEA, NCTA, Verizon, AT&T etc. Impossible. [NCTA, Direct TV, TimeWarner]

- Commission had ruled earlier that interoperability is not required between Cable, Satellite and Telco. [Dish]

3.1.1.8 Leased vs. Retail

Leased

- Majority believes that consumers want to only lease the boxes, and separable security is just adding to the cost. [NCTA, CISCO, Time Warner]
- Consumers overwhelmingly want to lease devices, instead of buying it. So retail availability is unnecessary. Leasing allows a service provider to procure in large volume, thus driving down the price. (DirectTV)
- Leasing a set-top box at a low, monthly charge offers an attractive way for consumers to enjoy advanced services without significant upfront equipment costs; allows consumers to upgrade easily to newer model devices and thereby avoid the risk of equipment obsolescence; and enables consumers to switch from cable to other MVPDs without being inhibited by the sunk cost of purchased equipment [Motorola]

Retail

- A DVR market has not emerged, like that of VCR. A Gateway is required for a retail market to emerge. [CERC]
- Subscribers who chose to purchase rather than lease should not be discriminated against in subsidies and bundling. [CERC]
- The CA details and content access details should be available to the retail manufacturer, to be able to compete with the leased devices. [Sony]
- MVPD's continuing ability to leverage control over design and functionality of competing products has been the prime impediment to true "Plug&Play" and innovations in video devices. [TIVO]
- Consumers should be clearly informed about the cost of leasing vs. owning their STB and the availability of competitive retail options. [Google]
- A Retail box can emerge if the service provider enabled the bidirectional feature of the 1394, didn't disable TV Guide and didn't disable controls for channels. [TI]

Problems in both

- Retail market failed to materialize due to lack of interest of CE manufacturers of CableCard compliant boxes. [ACA]

- The Motorola/CISCO duopoly stifles competition, from providing lower cost STBs. [ACA]

3.1.2 Technical Issues

3.1.2.1 1394 Interface

For

- Don't give waiver for 1394. [1394 Trade Association, CEA, TI]
- Force Cable operators to enable bi-directional features [TI]

Against

- Overwhelming majority feels that 1394 interface is redundant in today's context, and Ethernet interface has already taken over. [Intel, Verizon]
- Commission can give waiver for 1394 [NCTA]
- Commission can grant waiver for 1394 for HD set-top-boxes. [Motorola]

3.1.2.2 CableCARD

For

- FCC should get Cable Card implemented properly. [Google, CERC]
- Major Electronics manufacturers lost ground to Motorola/CISCO boxes. What was achieved for VCR could not be achieved for DVR. [CERC]

Against

- Cable Card and 1394 technology have been an unnecessary burden for the consumer. Cable Card is being superseded by DRM. [Motorola]
- Should remove obsolete CableCARD with Cable centric technology. [Verizon]
- Already accommodating third party boxes through downloadable CAS [Cablevision]

- Commission can give waiver for CableCard. [NCTA]
- Use Downloadable CAS within USB thumb-drive[BBT]
- Cable Card problem has come because of Motorola/CISCO duopoly [Irdeto, ACA]
- Use Simulcrypt for multiple MVPD support, instead of Cable Card [Nagravision, Irdeto, ACA, Transparent Video System]
- DVB-STB is available at the same cost as Cable Card [Transparent Video System]
- Use SD/micro-SD based detachable security [Transparent Video System]
- Commission is forcing costly solutions with CableCards, while exempting the same to DBS providers who are making inroads. [Baja, ACA]
- Separable security unnecessary. Consumer happy with leased STBs at lower cost. [CISCO]
- Tru2way has been an impediment for implementers. [TIVO]

3.1.2.3 HANA Interface

For

- HANA can be used for networking with 1394, with built in content protection. [TI]

Against

- Most of them pointed out that this is a non-issue since HANA is dead.

3.1.2.4 DLNA

For

- Use DLNA in Gateways. [DLNA, Intel, Verizon, Direct TV]

Against

- Security requirements from the Content Aggregators won't allow DLNA to be accepted. [NCTA]
- Not necessary to have DLNA. It is not a standard but guideline on how to use other standards such as uPNP. [Transparent Video System]

4 COMMENT ANALYSIS

4.1 The Convergence impasse

The Cable, Telco and DBS MVPDs are going in their own directions with their architectures. The DBS MVPDs have been exempted by the Congress from requiring a unified STB.

FCC attempted unifying the STBs amongst the Cable MVPDs through a “separable security” and an “integration ban”, which backfired. The separable security in the form of a CableCard is costlier than many of the DVB STBs. Instead of getting retailed, the STB based on CableCard is being leased out by the cable-operators with factory “bolted” CableCards. The smaller operators are unable to afford this STB, being made by a duopoly of manufacturers.

Lack of low-cost digital boxes has affected the plan of cable operators to go fully digital and spread broadband. FCC had to give waiver for DTA (Digital to Analog adapter) boxes, further creating complications in use of the “reliance” boxes (relying on Cable Cards).

Cable Card’s two-way functionality has been severely restricted for third party products such as TIVO. As a result, in spite of the high cost, the third party box cannot do much more than a simple VCR function. Third party manufacturers have desisted because of the unnecessary complicated architectural and certification requirement of CableLabs for “tru2way” boxes.

In a competitive world, where costs are used as filters, the tru2way boxes would have got weeded out much earlier. It is thus an irony that the Govt. mandate for creating an environment conducive for thriving of retail boxes, created a misfit product which had to be artificially protected.

With the best of the intentions, where did the things go wrong? The devil lies in details. The best of the plan can backfire if the details are not properly worked out.

FCC got some strong feedback from various stake holders to the recent Public Notice #27, which it released on December 3rd 2009. It was clear that most of the organizations were vehemently opposed to any further mandates from the FCC. They believed that what is in the consumer's interest will evolve on its own, with the sheer forces of competitiveness. So FCC should not make any new mandate. It should in fact give waivers to many of the earlier mandates which are coming in the way of progress.

On the other hand, various consumer oriented organizations, such as CERC, (Consumer Electronics Retailer's Association) pointed out that FCC has to intervene, to prevent further problems in the market place.

There seems to be little trust in any closed industry generated standards, such as that of the CableLabs. Many manufacturers and non cable MVPDs are not prepared to accept any further standards from the cable industry such as that for the Home Gateways.

NCTA (National Cable Television Association) has taken a strident stand, that separation of navigation and security functions are not acceptable to the Cable operators. The Studios have warned the Commission that content will move to other platforms if it is not adequately protected. The Gateway thus cannot be mandated on them.

There seems to be thus an impasse, where organizations who are opposed to any mandate want the FCC to go forward with a Notice of Inquiry, to further study the marketplace. Others, who want the FCC vision not to be aborted, want it to proceed directly to Notice for Proposed Rulemaking.

4.2 What should the FCC do at this stage?

Lose battles to win a War. There is no harm in letting the aggravated cable MVPD, have their way, so long as it doesn't come in the way of the bigger vision. As Chairman Genachowski has noted, the Internet – and the content available through it – must remain open, however accessed:

“Even though each form of Internet access has unique technical characteristics, they are all different roads to the same place. It is essential that the Internet itself remain open, however users reach it.”

Consistent with this vision, and in the spirit of internet, the “interoperable Video Device”, should allow any content to be fetched, irrespective of whether it is located on the internet or on a MVPD's Server. This vision won't be impaired even if the Video Devices are not able to access broadcast TV Channels along with their TV Guides, which lie in the domain of STBs. The reverse also can hold, in not requiring the STBs to access the Internet Videos [CISCO].

The STBs would continue their dedicated role of accessing the Broadcast Channels of the cable and satellite MVPDs. Both the Broadcast Channel STBs and Internet Video Devices, having evolved differently, would be more comfortable continuing in their own respective directions.

The Broadcast World thus gets accessed through an STB and the Internet World through a Video Device. Both the worlds would converge at a TV. Although, it is possible to further converge STB, Video Device and TV into a single device, in the immediate future, it would be better to let them evolve separately.

As per the vision, the Video Devices can access Internet videos from any HTTP Server. It can be a Home Media Server, a remote Internet Server, or now even a Content Server located right at the Head-end of the MVPD. A MVPD just has to connect a HTTP Content Server to his CMTS (Cable Modem Termination System), and all his subscribers would be able to access the contents on it at high speeds, with either PCs or Video Devices.

As per the security needs of the Studios, the MVPD can have his contents encrypted with multiple DRMs. A Video Device with a particular DRM, would be able to access the contents from the corresponding DRM Content Server of the MVPD.

The HTTP Content Servers, being the basic building blocks of the Internet, can be quite cost-effective. Moreover, they would be accessed by Video Devices using local bandwidths to the Head-ends, and not the internet bandwidths - decreasing their operational cost.

The path of least resistance of a user would lead to the Content Server at the Cable Head-end. The MVPD would be able to thus get the lion's share in all the contents which are accessed from the subscriber's Video Devices, including those from the internet.

This would create a win-win situation for all the ecology partners: the Subscribers, the MVPDs, the Video Device manufacturer, The Content Owners and the DRM Providers. With this the FCC will win the war of retail Video Devices.

4.3 Which are the small battles not worth fighting?

4.3.1 Integration Ban

Facing the onslaught from satellite, internet and telcos, the cable operators will figure out what minimum STB device will be the most cost effective for leasing and maximizes their revenues from the digital services.

- They can use the DVB Simulcrypt boxes, which are popular in Europe and very cost-effective. This will provide interoperability between Cable boxes too.
- They can use boxes with Downloadable CA System, instead of CableCards.

- Cable Cards need not be used. They cost as much as some of the DVB STBs.
- Let Cable Operators lease the boxes in the manner they deem fit. The consumer will anyway not buy these dedicated boxes.
- Market will open up to manufacturers of DVB boxes, who could not earlier afford the CableLabs solution.

4.3.2 DTA boxes

Let Cable operators deploy these cost-effective boxes for the low-end subscribers who want the minimum services. This way, they can convert their entire network to digital and offer more Cable Modem channels for new broadband services.

- Let Cable Operators use Switched Digital Channels and Electronics Program Guides in a proprietary way. It doesn't create any problem if no retail box has to access it.

4.3.3 1394 interface

Let the STB manufacturer decide whether they want to support it, in spite of the higher cost. The problem of 1394 not allowing any control or bidirectional features won't trouble, if retail devices don't have to interface to it.

4.3.4 Home Gateway

A Home Gateway does not have to be mandated. The existing Cable Modems will do the job amicably with the Video Devices.

- The MVPD will take care of hosting DRM Content Servers, based on DRMs which are approved by his Content suppliers.
- The manufacturers will implement those DRMs, even on existing devices, which will allow the subscriber to access the contents from most of the MVPDs.
- A new Video Device, having a STB chip with an integrated secure processor, will allow any DRM client to be dynamically downloaded.

4.3.5 MVPD and their Content

No need of delinking MVPD from their content. This has been as such objected by the Congress in case of satellite MVPD.

- MVPD can act as a Content Aggregator, and pass his encrypted contents for use by Content Servers of the associated Cable Operators.
- MVPD can earn from the License key served through Internet. With time he can become a major distributor of contents in many geographical regions of the world, for which he has gained the rights.
- Most of the small and medium cable operators don't have to have the burden of negotiating for contents. They can get the carriage fees for the mirrored Content Servers, much like the internet service.
- Since the same contents would be available with some other MVPDs and Content Aggregators too, an MVPD will have to be competitive in the pricing policy. With a rough parity, the subscriber will still prefer downloading the contents at high speeds from his Content Servers.

4.3.6 Selectable Output Control (SOC)

MPAA has applied for a waiver on Selectable Output Control ban. It wants to use SOC to prevent new movies being viewed on analog outputs, and pirate copies being made easily.

- There is no harm in FCC giving the waiver, since this will allow the movie to come earlier to the TVs (within few weeks), and within the traditional four months period for release on DVDs, the SOC controls then would not be needed (as the DVDs can anyway be copied easily).
- SOC waiver, will not prevent camera copies from the HD screens from proliferating. These can be at least as good as the SD screen. Unless MPAA and MVPDs evolve user friendly pricing and controls, the piracy will undermine the efforts.
- SOC waiver will give a boost to the Video Device manufacturers, to spread their retail boxes, with the lure of new movies.

4.4 What are the ensuing advantages to Video Devices?

- The future is in IP infrastructure. This has been acknowledged by all MVPDs. The Video Device design should be IP-centric and not Cable Centric [Verizon]. With this all the Video Devices will automatically become *network agnostic*.
- All existing Video Devices are already being sold from retail and have become popular. The popularity will further increase with the ability to use the same Video Devices on the MVPD networks too. Thus an expanding retail market would be assured.
- No need to interface with 1394, and find that the necessary controls are not available.
- No need to worry about not getting proper EPG, Channel controls etc.. Cable operators also don't have to worry about the patent sharing for EPG, Streaming Videos etc.
- No need to worry about discovering contents of MVPDs. Standard HTTP protocols can now be used to browse through the directory structure of the HTTP Content Servers and the contents hosted on it.
- No need for going through the arbitrarily long certification process from Cable Lab. The only thing to be certified is the DRM client.
- No need to afford the royalties for tru2way firmware and Java.
- No increase in cost due to provision of slots for CableCard. Video Devices also don't have to carry the additional burden of RF tuners.
- Missing out on the live channels may not affect the popularity of Video Devices – Live channels can always be seen with the simple leased STBs. The Video Devices will be primarily used for seeing the TV program on a VOD basis, from the Head-end Content Server.
- Minimal standards and guidelines are needed for kicking off the Video Devices ecology. Further growth will happen automatically afterwards, as in the internet.
- Once the critical mass of Video Devices is achieved in the homes, the existing restrictions would start crumbling, with the efforts of all the ecology partners.

4.5 Conclusion

- The Video Devices would specialize in VOD services, and wouldn't be dependent on channel and TV guide services which would continue to be accessed through the existing STB.s (It is another matter that somebody can combine both functionalities into a single new box)
- The existing STB boxes with cable MVPDs should not be disturbed and their traditional functionality should continue.
- Waiver can be given for 1394 interface, as the new IP Video Devices would not need to interface to it.
- Cable Cards and separable security are no longer required.
- No need of designing a new Gateway, which will be mired with enough complexities of interoperability, especially from the content security point of view.

5 NetMagic Solution

5.1 Basic Concepts for the Video Device Ecology

5.1.1 Use QAM for Channels

- There is no long term advantage in changing existing cable channels delivery mechanism, which have evolved through decades.
- Changing them will require change of the entrenched infrastructure at the head-end, network and the user-end.
- Most of the traditional STBs just allow simple minded channel browsing, without any DVR functionality.
- A separate tuner, in the RF delivery medium (coax, terrestrial and satellite), is required for every channel which has to be simultaneously displayed or recorded. This becomes a major limitation.
- In the VOD world, where all the pre-recorded contents can be got whenever required, there is no such constraint.
- The VOD world, works best in the IP domain and even the cable MVPDs have acknowledged this.
- It is thus best to let the existing cable medium retain their functionality which is well suited for delivery of “live channels”.

5.1.2 Use IP for VOD contents

- Through a separate Cable Modem, the MVPD can make available his VOD contents to Video Devices over an Ethernet or Wireless LAN.
- The contents from the Content Server will be fetched through local IP address, which don't have to go through internet. Hence there are no cost overheads for unlimited access of contents.
- The IP protocols allow fetching of contents from existing HTTP server, which work as a Content Server.

- The user still has the freedom of going through the internet to any other DRM Content Server for fetching Contents or the associated License keys. In this case though he will have to download contents from internet, and will be charged accordingly by the cable operator.
- A single Cable Modem, with up to 60 Mb bandwidth, should be sufficient for connecting to a Home LAN with three Video Devices. It would allow each of them to simultaneously fetch a different HD level content.

5.1.3 Inherent limitations of Streaming Servers

- Streaming Servers have been traditionally used at the head-ends for sending videos, in the manner of real-time channels. The clients on the other side didn't require any resource for instantaneous display of the channels
- The Streaming Servers, simulated VCR controls, using resources at the Server end.
- All the policies associated with playing of a content were implemented at the Server end – for instance the “play-duration” allowed.
- Streaming servers require to dedicate CPU, memory, storage and network bandwidth per user session, even though the user might be re-using the same few contents.
- Streaming servers have to limit themselves to the instantaneous real-time bandwidth available to the end-user's Video Devices. This requires either being able to dynamically re-encode the content at different bit rates through special hardware, or use of some pre-encoded files at different bit rates.
- When the bandwidth of a connection reduces due to number of factors such as congestion, noise, etc. the user would find quality degradation for the same content.
- Licensing fees of the streaming servers is dependent on the simultaneous users it can handle.
- The cost of Streaming servers is thus much higher than the simple HTTP servers, which have made the internet possible. The latter can be implemented on any PC.

- Typically the Streaming clients don't store any videos, even though it would be having a hard-disk storage, as in a PC. It thus has to always be on-line. It is not possible for a user to use it for portable applications, or while the network is down.

5.1.4 Paradigm shift to HTTP Server/Client

- Video serving with HTTP Servers, widely used in internet, is simplicity itself.
- Each of the HTTP Client has a mass storage along with it, for downloading the contents.
- Once a content is downloaded it can be played any number of times, without consuming the network bandwidth.
- A Video Device can fetch the content as it is playing. It would be able to fetch ahead if the available bandwidth is more than what is required for playing the content.
- Content can be fetched from any location, so it is not necessary to fetch the entire content, to view only some parts of it – this optimizes the bandwidths.
- The contents can now be fetched in the background. The original bit rate can be preserved, irrespective of the on-line bandwidth available. Thus, there won't be any compromise in the Video quality. It would be possible to distribute HD videos, irrespective of the limitations of the online connection.
- Although on-line downloading would take a few hours, transferring the same through a physical medium such as DVD, USB Pen-drive or Hard-drive can be done in minutes. Thus sharing of contents with others becomes intuitive. Irrespective of how the content was transferred, the MVPD will earn when the content gets played. This, then conveniences everyone.
- File sharing on a LAN on a P2P basis, becomes straightforward. The same can be extended to sharing through a WiFi, WAN or any other new medium. In P2P transfers there is no load on Content Servers, while the eventual earnings remain intact.

- netmagic**
When it's mission critical

5.1.5 Universal Content ID

- For the sake of Interoperability each Content has to be given a unique ID.
- The Universal Content ID (UCID) will conform to the general restrictions of a long file name in most operating systems.

```
<UCID> ::= <preamble><Content-AggregatorID>
           <language ID><year>["("<Series title>")"]<specific title>
           [" "<tags>"] "." <file extension>
```

<preamble> ::= Sequence of characters identifying the nature of the content. Starts with two fixed characters for indicating a UCID format. Example:

uCM – Movie

uCT – TV Serial

uCV – Song Video

uCA – Song Audio

<Content Aggregator-ID> ::= Upto 4 Digits, identifies the specific
Content Aggregator or MVPD.

<Language ID> ::= Upto 3 characters for the Main language, according to
ISO notation

<Year> ::= 4 Digits indicating year of production

<Series title> ::= ASCII String including spaces

<specific title> ::= ASCII string including spaces

<tags> ::= Series of tags. Each tag is separated by a dash.

No spaces should be present within tags.

Each tag is used to indicate some important attribute,
such as censorship rating.

<file extension> ::= same as what is used in computers with that
type of file.

5.1.6 License Key

- Are given by a DRM Content Server with a MVPD to the authorized Video Devices.
- Each authorized Video Device is identified by a MACID.
- Each DRM Content Server has within its secure database a list of approved MAC-IDs and a list of DRMs it can use. It also stores a unique “Encryption key” for encrypting the Content key into a License key.
- The “Encryption key” is such that only that specific Video Device would be able to decrypt the License key, and take out the Content Key, required for decrypting the associated content.
- It is the primary responsibility of the DRM client to ensure that the Content Key and the Content is never available in clear to an OS or its applications, and that no hacker can with hardware or software means be able to get to the same.

<:License Key> ::= <clear portion> <encrypted portion>

<clear portion> ::=

<UCID> <issue-date> [<expiry-date>] [<play-duration>]
[<display-restrictions>] [<cost>]

<encrypted portion> ::= <encrypted clear portion> <encrypted key>

5.1.7 Organizing contents in the HTTP Server

- HTTP Servers are easiest to use and maintain, because of their wide spread use in internet.
- Most of the content on the internet can be found on FTP or HTTP server. These can be organized and browsed even from a remote computer, using standard browsers.
- All the encrypted contents of a MVPD can be organized in a hierarchical manner using the directory/sub-directories of a HTTP Server.
- Service browsing is possible using HTTP GET command, which returns an XML document formatted as per conventions of RSS 2.0.
- A content is normally spread over multiple files, it will be a collection of multiple related files, stored in a directory with UCID as the name (without the tags). Example for a movie, the UCID folder will contain:
 - The actual encrypted file of the movie. HD Version
 - The actual encrypted file of the movie SD Version
 - The associated .xml metafile.
 - The xml files for subtitles in different languages
 - The preview books

- The trailer in HD
 - The trailer in SD
 - JPEG or PNG of the Poster
 - Associated video, such as Making of the Movie
-
- The navigation software in a Video Device can go through the directory structure and find out all the UCID folders. It can choose to display this information in a manner it deems is best.
 - The HTTP commands can allow the Server to send files which are dynamically compressed in transit to conserve bandwidth. This can save on the navigation time.
 - The non-UCID directories would have names associated with categories. The icons illustrating the category can be included in a JPEG file.
 - In order to keep a UCID folder accessible from several directories, it may be best to keep it in one place (say at the “All” directory at the root level), and have a link to it from other category directories. This way there won't be multiple copies and maintenance would be easy.
 - The best part will be that, the HTTP Directory structure can be browsed in a raw way through existing Internet browsers – allowing immediate use by millions.
 - Its up to each Video Device to make the browsing more user friendly and intuitive, using its own navigation screens.
 - Like other internet standards, the standard for keeping all the information on the HTTP Content Servers, can also evolve with inputs from internet and industry bodies.
 - It will be easy to keep up with the new standards, through remote upgrading of firmware versions.
 - As the HTTP Server will be available on Internet, its contents will be searchable through Internet Search Engines. This will allow a user to search for the contents of his choice. The UCID given in the search result will allow the Video Devices to fetch the corresponding content from the Content Servers at the Head-end.

5.1.8 Attributes of a user-friendly DRM

- A DRM should uphold user's rights and not restrict him unnecessarily.
- The DRM should be as simple as possible so that its short term and long term effects can be easily visualized by any user.
- DRM should allow copies to be made over any media of any encrypted contents. There should be no restrictions whatsoever; since it is the DRM's duty to ensure that the copies cannot be viewed unless authorized.
- DRM should allow any copy of a content to be used on a Video Device along with a "License Key". The License Key will be customized for that specific Video Device, and will not be usable on any other device.
- The DRM should allow certain policies to be encoded along with the License Key. For example the content play duration, expiry date, video output interface restrictions and so on.
- The Encrypted Content as well as the License Key can be backed up so that they can be restored on the original Video Device as required.
- DRM Servers should allow License Key to be given for Library Contents, without separate charges, in lieu of the monthly library fees.
- DRM Servers should allow the Content Aggregator to charge for a Prime Content, and vary the prices on a day-to-day basis, and also on the basis of geographical area where the License Key is being served.
- Each content should be identified by a unique ID (Universal Content ID), which should embed an ID for the corresponding Content Aggregator too. Thus it would always be possible to fetch via internet the License key from the original Content Aggregator.

5.1.9 Advantage of a Multiple DRM solution

- Existence of Multiple DRMs at a MVPD Head-end, would obviate a need of a single DRM. The single DRM moreover would have to be an Open DRM, on whom every one can trust.
- Multiple DRM at a Head-end will be similar to the Simulcrypt and Multicrypt solution for the Channel Head-ends. They allow the same

channel to be associated with number of CA systems, which could independently give their keys to the subscribers.

- There would be no immediate necessity to decide on a common format for Audio/Video encoding and the Container formats.
- Each DRM Content Server, can now choose to encode and encrypt their contents using their specific formats, such that their Video Devices are able to decode.
- Each DRM can now be of proprietary implementation (as before). It will be used so long as it is trusted by the Content owners and the MVPDs, and there is no problem in the field.
- A DRM which hassles the user, without any tangible benefit to the content owner will automatically get weeded out.
- It would be possible for standards bodies to regulate the common interface criteria for the DRMs, for allowing interoperability.
- A MVPD will not be over-reliant on any DRM. If it backfires in the field, the DRM Content Server itself can be shut down. The devices having other DRM clients won't be affected.

5.2 Interoperable Video Device

- The existing Cable modems, available from the retail will be used for connecting to the Home Ethernet LAN. The Video Devices would plug and play, on the Home LAN.
- HTTP Mirror Servers host the secure contents at a Cable Head-end.
- A MVPD hosts his secure contents on a DRM Content Server. The License Keys for the secure contents can be given through different DRM License Servers, to cater to the need of Video Devices with different DRM clients. (This is similar to Simulcrypt scheme for an encrypted channel being used along with multiple CA systems).
- Each Video Device will support at least one of the recommended DRMs. Although it can fetch the content directly from a Mirror Server at the Head-end, the License Key will have to be fetched directly from the corresponding DRM Key server of the MVPD through Internet.

- Existing Video Devices such as TIVO, iPOD, XBOX and PS3, just have to upgrade their boxes with a new certified firmware with the required DRM.
- The existing PCs, can also function as a Video Device, with a Certified Downloadable DRM...
- The Video Devices will access the global internet through global IP, and Head-end Content Servers through local IP.
- The Video Devices have to initially identify themselves, with their MAC-ID. Only the certified Video Devices with the required DRM will be able to interact with the corresponding DRM Content Server.
- A DRM Content Server, will use DRM Modules for generation of a License Key. The License Key will be de generated by a DRM Module by encrypting the Content key along with the policy parameters.
- The Content Key will be randomly generated. The administrator can also associate some policy parameters for use along with the key.
- The DRM Content Server, will encrypt a content with a randomly generated Content key (say AES-128). It will keep the Content keys and associated policies in a secure data-base. The keys won't be accessible even by an administrator.
- Unique IDs for Contents, Content Aggregator, DRM etc., would be encoded within the "Universal Content ID" (UCID)..
- The Content within a DRM Content Server is kept in the directory structure of a standard HTTP server, which can be accessed using the standard HTTP call from any IP network.
- The Video Devices can access the HTTP Content Server, and display the available contents in their own formats and using their own navigation screens.
- Metafile in XML format will be available for use along with the videos. These can be standardized by some associations for ensuring interoperability.
- The encrypted videos can be downloaded using HTTP protocol, using the local bandwidth. Unlimited downloads of HD level contents can occur, without using any Internet bandwidth – saving on both the cost and the congestion.

- The encrypted content is stored in the local flash or Hard-disk of the Video Device. It can be even played through a RAM buffer, in a diskless Video Device.
- For playing any content, a License key needs to be got from the DRM Content Server. These License keys will be different for each Video Device, and would thus be not transferrable.
- The License key will actually be a file having a clear part in the beginning, followed by binary data. The binary data will include the clear part too, so that there can be no subversion.
- The License key will also specify, the issue date/time, expiry date, play duration, display interface restrictions, costs etc., as per the policies enforced for the content. Display restrictions would allow indicating if the content should be played through HDMI only, and whether ID of the player should be overlapped, to track any Camera copy.
- The DRM Content Server will also keep a record of all the License keys given and the associated cost, for user billing.
 - License Keys for Library contents can be given to a Video Device without separate charge, based on the monthly subscription.
 - The DRM Content server can deny keys to some Video Devices, based on payment or policy problems.
- The user is free to transfer the encrypted content from one Video Device to another through LAN, Internet, or physical medium. It will always remain in the original encrypted form. A different License key will be needed for playing the same content on a different Video Device.
- The License keys are given by the original DRM Content Server through the internet to a certified Video Device. This would allow earning from each usage, wherever the Video Device gets used.
- The Video Device doesn't need to have the HTML browser and plug-ins for the basic video navigation features which require only the HTTP protocol. In view of the significant royalties, an entry level Video Device without the browser and plug-ins can be more cost-effective.

5.3 DRM Provider Benefits

- With the market of Video Devices expanding, the DRM providers have the opportunity to provide secure and versatile DRMs for various Video Devices – existing and new.
- DRM provider can achieve the ultimate security if the Video Device has a secure CPU. However, even without a secure CPU, the DRM provider can use his past experience (when secure CPUs were not available in STB chips), to craft out a binary which is not hackable.
- If any security problem is found with any Video Device, the DRM Content Server can always block sending of keys to it. In the extreme case the MVPD can disable the associated DRM Module in the DRM Content Server and thus block all the Video Devices with that DRM's clients. A new replacement DRM Client would then be mandated for the Video Device, before the DRM Model gets reused. This would ensure safety in spite of wide spread use.
- Since multiple DRMs can be co-resident on a Video Device, or within different Video Devices in a MVPD network, this would create a healthy competitive environment. The selection forces will weed out any problematic DRM.
- DRM Modules and Clients would be easy to test, maintain and in case of problems to be replaced.
- The DRM Content Server itself would keep the basic accounting data of the License Keys served to different Video Players. Integrated or separate billing could be generated with this data.
- DRM providers can earn based on number of Video Devices on which their clients are installed.
- DRM providers can earn potentially from all MVPDs as each would accommodate all the popular DRM Content Servers.
- DRM provider can continue to innovate and release new DRM clients to take care of new requirements, as mandated by evolving standards.

5.3.1 Single DRM Devices

- The existing Video Devices which do not have a separate CPU or a special ASIC (for Downloadable DRM) can have their firmware customized for a specific DRM.
- This DRM will be certified by the concerned vendor for the safety of the contents.
- Versions of the same Video Device could be available for different DRM. A user can even have a new version downloaded through the internet.
- A Single DRM Device should be fine for a MVPD, so long as he supports the required DRM in his DRM Content Server.
- In the unfortunate case that a Single DRM Device was hacked, the MVPD can always disable the associated DRM in the DRM Content Server.

5.3.2 Multi-DRM Devices

- These would be based on new generation processors which have a separate security CPU within it.
- The secure CPU will come with a DRM Loader supplied by the Chip manufacturer (and certified by some Certification Authority). The DRM Loader will be accessible through some standard APIs from many operating systems (OS).
- The OS will handle all the normal functions such as fetching of contents and their License Key. By looking inside the clear portion of the License Key it can find out the associated DRM and the Content Server.
- Many Secure processors have a built in unique ID. A DRM Provider can use it for customizing a DRM binary so that it can be used only along with that processor. This will allow new DRM binaries to be added to a Video Device on a need basis.
- The OS should be able to download into the secure processor any DRM binary required for playing a particular content. It will then supply the License key to the DRM, so that it can decrypt the content and play it internally.
- The DRM Loader will also provide APIs to the DRM for the time of the day function. The DRM can cross check to see that the time is not

inconsistent. For example, if a user sets back the system clock, the issue-time of a License Key will become higher than the system time. In this case, the DRM can suspend playing (requiring a factory reset, etc.).

- The DRM Loader will save back the secure work area of a particular DRM, and restore it on a subsequent reload – thus providing the continuity. This will allow the DRM to remember the “play-duration” remaining for a particular content, and thus enforce the policies.
- New versions of DRMs or new DRMs themselves can be automatically downloaded. Only the “signed and encrypted” versions will be used by the DRM Loader. This way the future obsolescence can be avoided.
- Note that the DRMs, are essentially as simple as one way Conditional Access systems, and work with just the OS supplied Content files and the License Keys. They don't have to do any handshake with any Server. They can be thus simple, compact and robust.

5.4 FCC benefits

- No need to change any regulations for the Cable MVPDs. (Waiver for Cable Card & 1394). The status-quo can continue.
- Existing DOCSIS 3.0 Cable Modems, which are there in the retail, get used. These can provide download speeds from 10 Mbit to 60 Mbit, for a wonderful experience – higher than what the existing broadband can give.
- Existing PCs and Video Devices, which are already available in retail can be used.
- The retail Video Devices can be used on any LAN with Content Servers or Internet Servers.
- Can work along with the industry and users to define the fair policies regarding content usage, which get implemented by the approved DRMs.
- No problems about evolving a common standard for an Open DRM, or relying on a single vendor or even a consortium. The existing vendors who have sufficient experience would do a good job.
- No Problem about standardizing the Audio/Video Codecs and the Container formats. Let each DRM and CE vendor choose what it feels comfortable with. Interoperability will not be hampered.

- All the stake-holders will have a level playing field where everyone can win. They will thus be happy to build the new ecology together under the guidance of FCC.
- FCC has to do the minimum hand-holding as the industry associations are capable of chalking out the few required interfaces for interoperability, themselves.
- Innovations on all fronts will get a boost and FCC's broadband penetration goals through the Video Device coupled with the TV will be achieved.

5.5 MVPD Benefits

- NCTA (National Cable & Telecommunications Association) can oversee the final convergence of both the Channels and VOD on the Cable networks hand-in-hand with an expanding market of retail Video Devices.
- MVPDs can continue earning with the existing STBs, and internet services.
- The MVPDs will be able to get VOD revenues from every Video Device, which earlier would have only interacted on the internet.
- MVPDs don't have to give the existing TV guides and Channels to Video Devices, and can avoid complicated patent issues in sharing.
- Can convert the whole cable to digital (through the DTA waiver), for maximizing channels available for cable modems. Can push the Content Server connectivity further down the cable branches to provide more bandwidth to homes.
- There would be a much lesser load on the internet at the head-end, as users would be able to download bandwidth guzzling videos from the Head-end Content Servers itself.
- Standard HTTP Servers would be used as Content Servers, and would allow services to be provided at a fractional cost of the Streaming Video Servers. The scaling up would be simple to meet the increasing usage demand..
- No dependency on a single DRM. With multiple DRMs in the DRM Content Server, even with a single DRM disabled, others can continue

their services to the Video Devices having the corresponding DRMs. This reduces the exposure, in case of any problem in a specific DRM.

- MVPD can block any erring Video Devices.
- The existing content agreements linked with specific DRM providers and Content Owners don't need to be changed.
- With P2P content sharing amongst Video Devices, the load on the Content Server will become light. Irrespective of how a content file was acquired, the DRM Content Server will need to give the License key before the content can be played, allowing further earnings.

5.6 Business Models

MVPD can continue his existing relation with his Content Supplier, and expand the market for his contents with different business models. His Head-ends can host, apart from his own Mirror Content Servers, those of other business partners – leading to more earnings.

Each DRM Content Server can provide three categories of contents: Owned, Prime and Library.

5.6.1 Hosting of Content Servers

- The MVPDs can also provide a Hosting Service for Mirror Content Servers of Content Aggregators such as NetFlix.
- The arrangement between the MVPD and the Content Aggregator can be based on a fixed monthly cost or revenue sharing.
- The Content Aggregator can use his own DRM with his contents. Any Video Device compatible with that DRM would be able to play the content.

5.6.2 Owned Contents

- Owned Contents will provide unlimited usage. The License Key will indicate unlimited usage by putting the "Expiry Date" and "Duration" fields as null.

- The License Key would be tied to a particular Video Device (based on the MAC-ID) and the contents won't be playable on other Video Devices.
- In case of loss of a Video Device, a new License Key will be required to play the content on a different Video Device. The Service provider can provide the same to the new MAC-ID, after debarring the previous MAC-ID for any further keys.

5.6.3 Prime Contents

- A MVPD can declare any content as a Prime Content and have policies associated with the License Key.
- The License Key will encode:
 - The issue date/time
 - The Play Duration in hours allowed for the content.
 - The Expiry Date
 - Whether the Content should be played only through HDMI with the HDCP protection.
 - Whether the Content should show the Video Device ID, intermittently as visible watermark, to deter Camera copies.
 - The Price charged for the content
- The MVPD can now have a more flexible expiry date for a new movie, say one week, and keep a tight limit on the duration of play, say 6 hours. This will allow the user to play at his convenience while not encouraging him to share his Video Device with others..

5.6.4 Library Contents

- Most of the Prime Contents will eventually land up as Library Contents.
- The License Keys for Library Contents will have a one month expiry date, and will allow unlimited usage within it.
- So long as the Library Fees are being paid every month, new License keys would be given automatically by the DRM Content Server.

- Even if a box is lost or damaged, the Library Contents can be used next month on a different box, with the regular Library fees.
- Most people will prefer the Library model, rather than Ownership model for convenience reasons.
 - They don't have to keep a tab on all the contents they own, and whether they are still usable on the Video Device.
 - They don't have to worry about any mishap of the Video Device, getting a new Video Device registered in its place, and getting fresh keys for the owned contents.

5.6.5 Backup of Contents

- The user will be able to back-up copies of the contents and License keys. In case there was an accidental loss of the content within the same Video Device, the contents and the License keys can be restored.
- Even if the earlier Video Device is rendered unusable, the backed up Contents can still be used with a newer Video Device. Just the License keys will have to be re-fetched, not the Contents.

5.6.6 Sharing of Contents

- It would be easy now for users to share any contents with other users through any physical or on-line medium. The contents will remain in the encrypted state.
- When a copied content is played on any Video Device, anywhere in the world, it will have to fetch a new License key from the corresponding DRM Content Server over the internet.
- The DRM Content Server can give the keys to the Video Device registered with it, so long as it is detected that its internet address is within its geographical serving domain.
- DRM Content Server can of course implement different policies for different regions.

5.7 CE Manufacturer Benefits

- FCC Video Device will become a Game Changer, and expand the market multi-fold – for internet as well as MVPD networks.
- Video Device will become more cost-effective as 1394 ports and Cable Card slots won't be mandatory. There will also be no requirement of tuners for interfacing to QAM channels..
- Costs will further come down with mass production, making it easier for the consumer for an outright purchase of a Video Device.
- The CE manufacturer can continue using the existing navigation interface of the Video Device.
- Can build a range of compatible devices, from the basic low-ends to feature-rich high ends – just like in the case of mobiles.
- CE manufacturer won't be dependent on a single DRM provider.
- Even a single-DRM Video Device can get a significant market share, if the associated DRMs are used by most of the DRM Content Servers.
- A world-wide market gets unleashed, with the same Video Device catering to diverse media such as, cable, satellite, terrestrial, IPTV, DVD and 3G.

5.8 Content Provider Benefits

- Can continue providing contents to the MVPDs with the approved DRMs.
- The contents will now get a much bigger market due to increase in number of Video Devices which can access them world-wide.
- The Content Provider can associate “policies” along with each content. These will be uniformly followed by all the DRM clients in the Video Devices.
- The exact usage and earning statistics can be made available online by the DRM Content Servers.
- The stand-off with users and user organization will be averted as the multi DRM approach will now be perceived as user friendly, especially when P2P sharing would become easy.

- Piracy problem will be finally over. The erstwhile pirates will become “no-cost” distributors.
- It would be possible to start with Selectable Output Control (SOC) at the time of release of a Prime Content, which can be relaxed with time. The user will not think of this as an impediment.

5.9 User Benefits

- A user can start off without having to buy any new devices. He can use his existing Cable Modem and PC, to get the new VOD services from MVPDs.
- An existing Video Device, may require only a remote firmware upgrade for use along with the new VOD services.
- Contents will normally get downloaded at rates higher than the normal playing rate. So unlike watching a TV channel, a user would be able to do limited fast-forwarding too.
- The downloaded contents can be watched even when the Video Device is not connected to the LAN (such as in a portable device), as long as the License key had been fetched earlier.
- Any content can be transferred through any medium to another certified Video Device. Of course, a fresh License key will be needed on the new device before it can be played.
- The user wouldn't have to bother about the traditional DVR problems of pre-scheduling and recording multiple programs, especially when they overlap in time. The Content Server can now provide all the aired TV programs to be seen on an anytime basis.
- The user will have the ability of seeing the contents in the highest available resolution, for SD or HDTV. There will be no artificial need at the head-end of overt compression to save on internet bandwidth (as local bandwidth gets used).
- QAM STBs and IP Video Devices will operate in parallel – each device having their own tuners. This would have been a problem with a combined device having a fixed number of tuners to be shared between channels and VOD contents.

- A user will be able to use his Video Device for connecting simultaneously to multiple MVPDs. For this his Home LAN has to interface to modems of different MVPDs. The Video Device can now access the contents of different MVPDs so long it has the required DRM clients.

6 Future Scenario

- With the proliferation of the FCC Video Devices, the Telcos will find it expedient to adopt the same, since their boxes had the same technical requirements.
- Even the DBS Satellites will then allow the prime contents (new movies), to be downloaded through their boxes into any Video Device. The Video Device, of course, will have to fetch a License key from the associated DRM Content Servers before the content can be played.
- Websites on internet just need to display the “Universal Content IDs” (UCID) for the videos. Clicking on each UCID will cause the Video Device to fetch the corresponding content from the Content Server along with the License key. Thus, sites like the IMDB, can give the reviews and allow a user the convenience of clicking to see the movie, without requiring the associated infrastructure.
- The MVPDs will complement the internet, by providing the missing bandwidth, security and accounting required for playing SD/HD level videos.
- TVs will emerge as the bigger Box Office, for instantaneous collection from all over the world.
- TVs will become simpler, and more powerful, when they embed the Video Device within them and offer features such as 3-D. Plug and Play can occur with just the Ethernet connector, and separate HDMI connector won't be needed. .
- A new era will start, with no content piracy problems. The erstwhile pirates would become low-cost distributors. It would be in the interest of the Content owners and MVPDs to encourage spread of the secure contents through internet, P2P, Flash drive and DVD medium – since their viewing would still require fetching of a License key from the MVPD.